## REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

The Specification has been edited to remove any informalities. A Substitute Abstract has been attached hereto that overcomes the objections in the Office Action.

Claims 1-7 have been amended to overcome all grounds of rejection under 35 U.S.C.§112, second paragraph.

(1) Claims 1-7 stand rejected under 35 U.S.C.§102(e) over U.S. Patent 6,201,911 to Jang, commonly owned and assigned to the present assignee.

Applicant respectfully disagrees with the statement in the Office Action that the application is held to the standard of 35 U.S.C.§102(e) prior to the AIPA amendments because the application was not filed on or after November 29, 2000. The U.S. filing date of the instant application is December 28, 2000, and this application was not voluntarily published under 35 U.S.C.§122(b).

Accordingly, based on dates alone, the application should be examined under 35 U.S.C.§102(e) according to the post AIPA amendments of 1999.

(2) Claims 1,2,5,6 and 7 stand rejected under 35 U.S.C.§102(e) over Bhatia et al. (U.S. 6,269,208, hereafter "Bhatia").

(3) Claims 3-4 stand rejected under 35 U.S.C.§103(a) as allegedly unpatentable over Bhatia.

(4) Claim 1 stands rejected under the judicially created doctrine obviousness type double patenting over claims 1 and 10 of Jang.

With regard to items (2-4) above, it is respectfully submitted that none of the present claims are anticipated by, or would have been obvious over, the cited references.

The presently claimed invention relates to a method for fabricating an apodized optical fiber using an amplitude mask. One aspect of the present invention is that the thickness of the amplitude mask is adjusted to match a stripe pattern of the apodized optical fiber grating with a pattern of light distribution on a light exit surface of the amplitude mask. In other words, by adjusting the thickness of the amplitude mask, a pattern of the apodized optical fiber grating can be conformed to that of the

optical distribution on the light exit surface of the amplitude mask. It is respectfully submitted that neither Jang nor Bhatia disclose or suggest this feature.

Accordingly, it is respectfully submitted that none of the present claims are anticipated because the all of the claimed elements are not disclosed in a single prior art reference. In addition, the Court of Appeals for the Federal Circuit held in *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628,631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987):

> A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

Nor would a person of ordinary skill have been motivated by the teachings of the references so that any of the instant claims would have been obvious in view thereof. Reconsideration and withdrawal of all grounds of ground of rejection are respectfully requested.

For all the foregoing reasons, it is respectfully submitted that all the present claims are patentable in view of the cited references. A Notice of Allowance is respectfully requested.

Should the Examiner deem that there are any issues which may be best resolved by telephone communication, she is respectfully requested to telephone Applicant's undersigned Attorney at the number listed below.

Respectfully submitted,

Date: May 6, 2002

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Enclosures - Substitute Abstract
Version With Markings To Show Changes Made

ABSTRACT OF THE DISCLOSURE

--A method for fabricating an apodized optical fiber grating. The method according to the invention uses an ultraviolet light source for outputting an ultraviolet layer, a lens system for converging or emitting the light incident from the ultraviolet light source, an amplitude mask for selectively transmitting the ultraviolet layer incident from the lens system, and an onto an optical fiber. At a first step, there is setting of a period of the apodized optical fiber grating and setting a width of each stripe of the apodized fiber grating. A second step includes setting a longitudinal ratio, which is a ratio of the distance between the converging or emitting point of the lens system and the amplitude mask to the distance between the converging or emitting point of the lens system and the optical fiber. A third step includes setting a cycle of the amplitude mask so as to equalize a transverse ratio, which is a ratio of the period of the amplitude mask and the period of the apodized optical fiber grating, with the longitudinal ratio set in the second step, and a fourth step includes setting a thickness of the amplitude mask so as to match the stripe pattern of the apodized optical fiber grating with a light distribution on a light exit surface of the amplitude mask.--

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Heu-Gon Kim et al. ART UNIT: 2872

SERIAL NO.: 09/750,576 EXAMINER: Audrey Y Chang

FILED: December 28, 2000

FOR: FABRICATION METHOD OF APODIZED OPTICAL FIBER GRATING USING AMPLITUDE MASK

VERSION WITH MARKINGS SHOWING CHANGES MADE

Assistant Commissioner for Patents
Washington, DC 20231

Dear Sir:

In response to the Office Action dated February 5, 2002, the Applicants request amendment of the above-identified application as follows:

IN THE ABSTRACT:

A substitute Abstract is attached hereto.

IN THE SPECIFICATION:

Paragraph beginning at on line 6 of page 4 has been amended as follows:

To achieve the above object, there is provided a method of fabricating an apodized optical fiber grating using an ultraviolet light source which includes a means for outputting an ultraviolet light; a [lens field] lens system for converging or

emitting the light incident from the ultraviolet light source; an amplitude mask for selectively transmitting the ultraviolet layer incident from the [lens field] lens system; and, an optical fiber for receiving the light transmitted via the amplitude mask.

Paragraph beginning on line 13 of page 4 has been amended as follows:

Accordingly, the method according to the present invention includes the following steps of: a first step of setting the cycle of the optical fiber grating formed on the optical fiber and the width of each stripe pattern; a second step of setting a longitudinal ratio, which is a ratio of the distance between the converging (or emitting point) of the [lens field] lens system and the amplitude mask, to the distance between the converging (or emitting point) of the [lens field] lens system and the optical fiber; a third step of setting the cycle of the amplitude mask so as to unify a transverse ratio, which is a ratio of the cycle of the amplitude mask to the cycle of the optical fiber grating, with the longitudinal ratio set in the second step; and, a fourth step of setting a thickness of the amplitude mask so as to match the pattern of the optical fiber grating set in the

first step with the pattern of an optical distribution on the injecting surface of the mask.

Paragraph beginning at line 3 of page 6 has been amended as follows:

Fig. 6 is a side elevational view illustrating the process of adjusting a converging or emitting point of the [lens field] lens system as shown in Fig. 3;

Paragraph beginning at line 8 of page 7 has been amended as follows:

Fig. 3 is a diagram illustrating the method of fabricating an apodized optical fiber grating using an amplitude mask according to the preferred embodiment of the present invention. Referring to Fig. 3, an ultraviolet source 31 illuminates light to be applied to the [lens field] lens system 32. The ultraviolet light source 31 includes an excimer laser. The [lens field] lens system 32 includes a [plain-convex] plano-convex lens 34 and a [plain-concave] plano-concave lens 35 spaced apart by length d1. When the light is emitted from the ultraviolet source 31 through the [lens field] lens system 32, the light emitted from the ultraviolet light

source 31 appears as if the light is generated from a single converging point, as shown in Fig. 5. Here, the point where the light injected from the [lens field] lens system 32 looks converged is sometimes referred to as a "converging point." Alternatively, the same point, from which the light injected from the [lens field] lens system 32 is emitted is sometimes referred to an "emitting point."

Paragraph beginning at line 20 on page 7 has been amended as follows:

In the embodiment of the present invention, the light transmitted through the [lens field] lens system 32 is incident on an optical fiber 37 after passing the amplitude mask 36 with a thickness of $t_1$. Accordingly, stripe patterns, referred to as gratings, of the amplitude mask 36 are formed along the length of the photosensitive optical fiber 37. An optical axis 38 represented by dotted lines in Fig. 3 represents a reference axis that is used to reference the major components of the present invention. Accordingly, all elements described in the preceding paragraphs have a rotational symmetry with respect to the optical axis 38.

Paragraph beginning on line 6 of page 8 has been amended as follows:

Fig. 4 is a perspective view of the amplitude mask 36 shown in Fig. 3. According to the present invention, the amplitude [ask] mask 36 includes a plurality of slits 41 arranged in a row with a uniform cycle period of $\wedge_M$ between each slit 41. The slit 41 has a width of $\wedge_M/2$, which is the same numerical unit as the distance between the slits 41. The amplitude mask 36 has a thickness of $t_1$, and the inner wall 42 constituting the slits 41 also has the thickness of $t_1$. Since the width of the slit 41 is relatively greater than the wavelength of the incident light, the light incident on the amplitude mask 36 typically transmits through the slits 41 without any refraction. Thereafter, the transmitted light via the amplitude mask 36 is incident along the optical fiber 37, as shown in Fig. 3, and then changes the refractive index along the length of the optical fiber 37. Accordingly, the periodic variations in refractive index formed on the optical fiber 37 serve as fiber gratings.

Paragraph beginning at line 18 of page 8 has been amended as follows:

Fig. 5 is a partial sectional view illustrating the process of forming the apodized optical fiber grating using the apparatus shown in Fig. 3. For simplicity, Fig. 5 illustrates a projected view of the light eliminated from the light source 31 starting from a [plain-concave] plano-concave lens 35, which corresponds to the last element of the [lens field] lens system 32 shown in Fig. 3. As described earlier, the light injected to the [plain-concave] plano-concave lens 35 will behave as if the light is generated from an emitting point S, and the generated light is illuminated onto the amplitude mask 36 with the thickness of $t_1$. The amplitude mask 36 includes an incident surface 51, through which the light is incident, and an injecting surface 52, through which the light is being transmitted.

Paragraph beginning at line 1 of page 10 has been amended as follows:

According to the present invention, the method of fabricating apodized optical fiber using the amplitude mask 36 is initially set to have varying illuminated width along [hte] the optical fiber 37

at with variation cycle of $\wedge_{G1}$ between each grating formed on the fiber 37. Thereafter, the method further involves the following steps.

Paragraph beginning at line 6 of page 10 has been amended as follows:

First, after setting a specific width and regular cycle of the gratings formed along the optical fiber 37 as described above, the second step is directed to setting an optimal longitudinal ratio. Referring to Fig. 6, the longitudinal ratio represents the ratio of the distance between the converging (or emitting point) of the [lens field] lens system 32 and the amplitude mask 36, to the distance between the converging (or emitting point) and the optical fiber 37. Fig. 6 is a side elevational view illustrating the process of adjusting the converging (or emitting point) of the [lens field] lens system 32. As shown in FIG. 6, by adjusting the distance $d_2$ in the [lens field] lens system 32, the light projected from the [lens field] lens system 32 can be arranged to be parallel with the optical axis 38. In particular, the adjustment of the projected light is accomplishes by adjusting the distance between two lenses 34 and 35 of the optical field 32. In the first step,

the distance between the two lenses 34 and 35 was $d_1$ as shown in Fig. 3, now that distance is adjusted to $d_2$ as shown in Fig. 6. However, the thickness of the amplitude mask 36 remained constant.

Paragraph beginning at line 6 of page 11 has been amended as follows:

For the purpose of clarity, Fig. 7 illustrates view starting from the [plain-concave] plano-concave lens 35, which is the last element of the optical field 32 shown in Fig. 6. Unlike Fig. 5, the light projected through the plain-concave lens 35 has a uniform parallel projection onto the optical fiber [38] 37 along the optical axis 38. As shown in Fig. 7, the inner walls 42 of the slits 41 are in parallel relationship with the optical axis 38 along the amplitude mask 36. Accordingly, any of the uniform light incident through the slit 41 is not blocked by the inner wall 42 of the respective slit 41 as the light pass through the amplitude mask 36. In particular, the width of the light projected through each slit 41 along the injecting surface 52 of the amplitude mask 36 does not become narrower even if some of the slits 41 is position distance from the optical axis 38 as in the first step. As a result, the widths of grating stripe patterns formed along the

optical fiber 37 through the light projected through the amplitude mask 36 have identical width, as shown in Fig. 7.

Paragraph beginning at line 19 of page 11 has been amended as follows:

It should be noted that the second step and third steps can be executed in any order in the present invention. Thus, it is not only possible to decide the cycle of the amplitude mask in the third step after setting the longitudinal ratio in the second step, but also it is also possible to adjust the distance between the converging (or emitting point) of the [lens field] <u>lens system</u> and the amplitude mask as well as the distance between the converging (or emitting point) of the [lens field] <u>lens system</u> and the optical fiber after setting the transverse ratio. Thus, if the distance between the amplitude mask 36 and the optical fiber 37 is fixed, the distance between the converging (or emitting point) of the lens field and the amplitude mask 36 can be adjusted to meet the target transverse ratio. Here, the [lens field] <u>lens system</u> is composed of a cylindrical convex lens and a concave lens. Hence, the converging (or emitting point) can be adjusted by varying the distance between the cylindrical convex lens and the concave lens.

Paragraph beginning at line 4 of page 13 has been amended as follows:

Referring to FIG. 8, the amplitude mask 36, to which the light injected from the [plain-concave] plano-concave lens 35 is incident, has a thickness of $t_2$. The width of the light projected through the injecting surface 52 of the amplitude mask 36 is slightly variable even if the slit 41 becomes distant from the optical axis 38. Such a phenomenon is attributable to the fact that the area where the light incident on the slit 41 crosses the inner wall 42 thereof is reduced even if the angle formed by the light incident on the slit 41 with respect to the optical axis 38 is the same as before varying the thickness of the amplitude mask 36. Thus, the apodizing degree of the optical fiber grating according to the present invention is varied by adjusting the thickness of the amplitude mask 36.

IN THE CLAIMS:

Please amend the following claims:

1. (Amended) A method for fabricating an apodized optical fiber grating using an ultraviolet light source, a lens [field] system for converging the light incident from the ultraviolet light

source, an amplitude mask for selectively transmitting therethrough the ultraviolet light incident from the lens [field] system onto an optical fiber, the method comprising the steps of:

[a first step of] (a) setting a [cycle] a period of the apodized optical fiber [of the optical fiber grating] formed on the optical fiber and setting a width of each stripe [pattern] of the apodized optical fiber grating;

[a second step of] (b) setting a longitudinal ratio, which is a ratio of the distance between a converging point of the lens [field] system and the amplitude mask and the distance between the converging point of the lens [field] system and the optical fiber;

[a third step of] (c) setting a [cycle] period of the amplitude mask so as to [unify a] equalize a transverse ratio, which is a ratio of the [cycle] period of the amplitude mask and the [cycle] period of the apodized optical fiber grating, with the longitudinal ratio set in [the second] step (b); and

[a fourth step of ] (d) setting a thickness of the amplitude mask so as to match the stripe pattern of the apodized optical fiber grating set in [the first] step (a) with [the] a pattern of [an optical distribution of] a light distribution on [the] a [injecting] light exit surface of the amplitude mask.

2. (Amended) The fabrication method of claim 1, wherein the ultraviolet light source [is] comprises an excimer laser.

3. (Amended) The method of Claim 1, wherein the lens [field] system [consists of] comprises at least one cylindrical convex lens and at least one concave lens.

4. (Amended) The method of Claim 3, wherein [the] said converging point of the lens [field] system is adjusted by selectively varying [the] a distance between the at least one cylindrical convex lens and the at least one concave lens.

5. (Amended) The method of Claim 1, wherein the [first] step (a) further comprises [the step of] exposing the ultraviolet light through the amplitude mask.

6. (Amended) The method of claim 1, wherein [the fourth] step (d) further comprises [the step of] exposing the ultraviolet light through the amplitude mask.

7. (Amended) The method of claim 1, wherein [the] a [slit] width of each slit of the amplitude mask is substantially greater

than the wavelength of the incident light transmitted from the lens [field] <u>system</u>.